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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

MUNEKATA ET AL

Application No.: 10/666,129

Art Unit: 1742

Filed: September 22, 2003

Examiner: Sikyin Ip

For: LEAD-FREE SOLDER ALLOY

SUBMISSION OF DECLARATION UNDER 37 CFR 1.132Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The attention of the Examiner is invited to the attached declaration under 37 CFR 1.132 which is presented as evidence of the unexpected effects provided by an alloy according to the present invention.

The declaration was prepared by Yoshitaka Toyoda, who is one of the inventors of the present application and an employee of the assignee, Senju Metal Industry Co., Ltd. Mr. Toyoda performed measurements of the wettability (as indicated by the zero crossing time) of various lead-free solder alloy compositions, including Sn-Cu, Sn-Cu-Ni, Sn-Cu-Ge, Sn-Cu-Ag, Sn-

Cu-P, and Sn-Cu-Ni-P compositions.

The results demonstrate that a Sn-Cu-Ni-P alloy with a P content of 0.001 to 0.1 wt % provides excellent wettability which is comparable to that of a Sn-Cu-Ag alloy but at a lower cost, since P is much less expensive than Ag as an alloying element. The practical value of the excellent wettability of a Sn-Cu-Ni-P alloy is highly significant, because it enables Sn-Cu-Ni-P alloys to be used in place of more expensive Sn-Cu-Ag alloys, which are presently the most widely used lead-free alloys in Japan for flow soldering and reflow soldering.

The outstanding wettability of a Sn-Cu-Ni-P alloy with a P content in the range of 0.001 to 0.1 wt % cannot be predicted from the properties of a Sn-Cu-Ni-(P) alloy with a P content outside of this range. From Exhibit 1 attached to the declaration, it can be seen that a Sn-0.7Cu-0.1Ni alloy, i.e., one containing no P, had a zero crossing time in a meniscograph test of approximately 5.21 seconds, while it can be seen from Exhibit 3 that a Sn-0.7Cu-0.1Ni-0.5P alloy had a zero crossing time in a meniscograph test of approximately 5.36 seconds. Interpolating between these values would give no indication of the very large and steep decrease in zero crossing time (and corresponding increase in wettability) obtained by a Sn-Cu-Ni-P alloy with a P content of 0.001 to 0.1 wt %, as claimed in the present invention. As such, the effects provided by such an alloy are unexpected, and the claimed alloy is not obvious from the prior art.

When viewed in conjunction with the remarks in the preliminary amendment filed on January 28, 2004, the attached declaration shows the patentability of the claims pending in the present application. Favorable consideration is respectfully requested.

Respectfully submitted,



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Attachment
Declaration under 37 CFR 1.132

Certificate of Transmission

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Signature Michael Tobias
Michael Tobias